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# Highlights of INT Program 14-3: Heavy Flavor and Electromagnetic Probes

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**Highlights of INT Program 14-3:**
**Heavy Flavor and Electromagnetic Probes**

The Institute for Nuclear Theory program, Heavy Flavor and Electromagnetic Probes in Heavy-Ion Collisions (INT 14-3), was held 15 September to 10 October 2014. In addition to the four organizers: Ramona Vogt (LLNL and UC Davis), Peter Petreczky (BNL), Anthony Frawley (Florida State), and Enrico Scomparin (INFN Torino), the program was attended by 34 other participants spread out over the four week period. Almost all participants were recognized experts in the field and were invited to take part. Eight of the participants were postdocs and five were women.

There are two main thrusts to the study of heavy quarks and quarkonia in heavy-ion physics: "hot matter" (effects specific to the high temperature medium produced in heavy-ion or nucleus-nucleus collisions) and "cold nuclear matter" (effects that are present already in proton-nucleus collisions and are a baseline against which hot matter effects must be compared) as well as production of the heavy quarks and quarkonium (bound states of heavy quark-antiquark pairs) in perturbative QCD. The program was structured so that the first two weeks were generally devoted to hot matter, especially lattice QCD. The second half was devoted to issues related to production and cold matter effects. An intense 2.5 day workshop, from 29 September to 1 October. Although a theory program, experimentalists attended throughout, giving talks on recent data and future facilities.

Alexander Rothkopf (Heidelberg University) presented calculations of quarkonium spectral functions and static quark-antiquark potentials at $T > 0$, employing a novel Bayesian approach, see e.g. INT-PUB-14-046 and Fig. 1.

Enrico Scomparin (INFN Torino) discussed the ALICE Collaboration results from $p$+Pb collisions. In particular, he discussed $\psi(2S)$ production at forward and backward rapidity. At backward rapidity, they find significantly larger suppression than for the more strongly bound $J/\psi$, see the left-hand side of Fig. 2. As described by Torsten Dahms (TU Munich), the CMS Collaboration has also shown results for the $\psi(2S)$, but in Pb+Pb collisions, where, although in a different kinematic region (central rapidity and transverse momentum larger than 3 GeV/$c$) they find an enhancement of the yields compared to $J/\psi$, shown on the right-hand side of Fig. 2. A consistent interpretation of these data poses nontrivial problems.

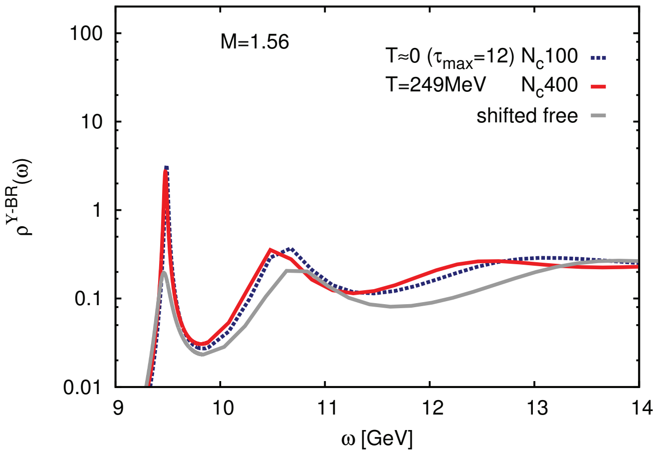


Figure 1: The $\Upsilon$ spectral function for $T = 249$ MeV and $T = 0$ both reconstrcuted with 12 points in the time direction using the novel Baysian approach.

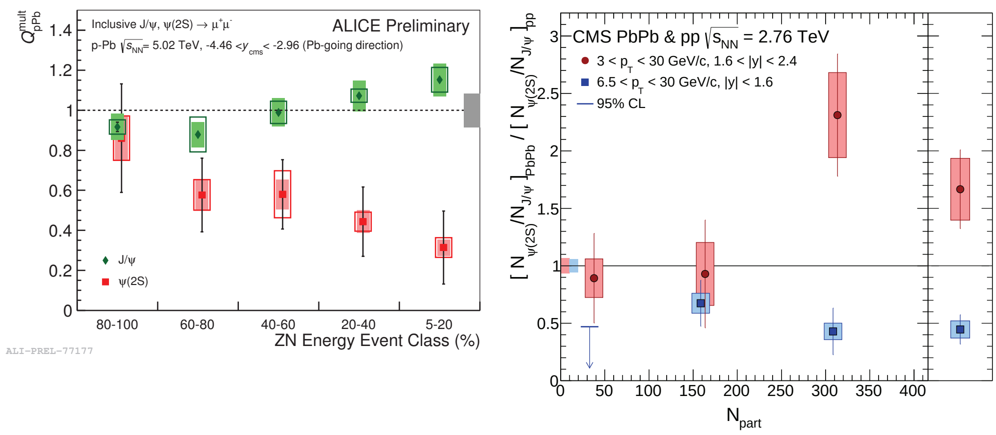


Figure 2: (Left) The nuclear modification factor $Q_{p\mathrm{Pb;mult}}$ for the $J/\psi$ and $\psi(2S)$ states at backward (Pb-going) rapidity, measured by ALICE, as a function of the centrality of the $p$+Pb collision (0-20% corresponds to most central events). (Right) The ratio $\psi(2S)/J/\psi$ for Pb+Pb collisions, normalized to the same quantity in $pp$, plotted as a function of $N_{\mathrm{part}}$. The results are presented for two different $p_T$ ranges. The right-most points correspond to the centrality-integrated sample.